The issues of correct evaluation
of economic growth

I. Serova

The formation of a correct information base in the research on economic growth has been studied. Typical situations have been pointed out where the process of data collection and primary processing, provided the accuracy and comparability requirements are met, is the basis for reliable information. There has been stated a need for prior examination of the complex structure of a system, such as the economy of a state with a view to achieving its qualitative homogeneity. It has been shown that if the problem of data homogeneity is a prerequisite for correct analysis, the structure of a specific system determines the choice of the method of its typology. The relationship between the combination type and approaches to determining their homogeneity has been presented. The necessity for the use of the measurement system, depending on the source of information and the current trends for an adequate choice of data analysis methods has been shown. The list of factors affecting the accuracy of economic measurement has been determined. Based on the fact that the index is a quantitative and qualitative generalizing characteristics of any population property in a particular place and time, the interrelation of the characteristics of economic indicators has been considered in accordance with the causes and sources of accidental errors. The accuracy of the indicator measurement over a long period of time has been proved to be determined by the uniformity of the development periods. According to the author the inconsistency between the official figures may be caused by different calculation for the different forms of presentation. The dependence of the common problems of price and output measurement on the signs of their occasioning has been presented. Indices as a standard method of economic dynamics analysis have been studied and interrelation of selecting a comparison base and similar intervals of analysis of indices has been shown. The possibility of using linked indices in the analysis of economic dynamics has been examined.

Keywords: economic growth, population homogeneity, typology of data, performance indicator, measurement error, index analysis.

· ·

Питання коректності оцінювання економічного зростання

Сєрова І. А.

Розглянуто питання формування коректного інформаційного базису в дослідженні економічного зростання. Виокремлено типові ситуації, коли процес збирання даних та їхнього первинного опрацювання за умов дотримання вимог точності й зіставлення є базою щодо отримання достовірної інформації. Констатована необхідність у першочерговому розгляді структури складної системи, якою є економіка держави, із метою досягнення її якісної однорідності. Показано, що якщо проблема однорідності даних є необхідною умовою коректного їхнього аналізу, то структура конкретної системи визначає вибір способу їхньої типології. Подано взаємозв'язок типу сукупності та підходів до визначення їхньої однорідності. Показано необхідність у використанні системи вимірювань, залежно від вихідного інформаційного матеріалу й наявних тенденцій, задля адекватного вибору методів аналізу даних. Визначено перелік факторів, що впливають на точність економічних вимірювань. Виходячи з того, що показник є кількісно-якісною узагальнювальною характеристикою будь-якої властивості сукупності в умовах певного місця й часу, розглянуто взаємозв'язок характеристик економічних показників, відповідно до причин та джерел виникнення випадкових похибок. Підкреслено, що точність вимірювання показників за довгий період часу визначено однорідністю періодів розвитку. Показано, що неузгодженість поміж офіційними показниками може бути спричинено їхнім різним розрахунком для різних

форм подання. Наведено залежність загальних проблем вимірювання цін та обсягу виробництва від ознак, що їх обумовлюють. Розглянуто індекси як стандартний прийом аналізу економічної динаміки й показано взаємозв'язок вибору бази порівняння та однорідних інтервалів аналізу показників. Розглянуто можливість використання зчеплених індексів в аналізі економічної динаміки.

Ключові слова: *економічне зростання, однорідність сукупності, типологія даних, оцінний показник, похибка вимірювання, індексний аналіз.*

....

Вопросы корректности оценки экономического роста

Серова И. А.

Рассмотрены вопросы формирования корректного информационного базиса в исследовании экономического роста. Выделены типичные ситуации, когда процесс сбора данных и их первичной обработки при условии соблюдения требований точности и сопоставимости является базой для получения достоверной информации. Констатирована необходимость первоочередного рассмотрения структуры сложной системы, которой является экономика государства, с целью достижения ее качественной однородности. Показано, что если проблема однородности данных является необходимым условием корректного их анализа, то структура конкретной системы определяет выбор способа их типологии. Представлена взаимосвязь типа совокупности и подходов к определению их однородности. Показана необходимость использования системы измерений в зависимости от исходного информационного материала и существующих тенденций для адекватного выбора методов анализа данных. Определен перечень факторов, влияющих на точность экономических измерений. Исходя из того, что показатель является количественно-качественной обобщающей характеристикой какого-либо свойства совокупности в условиях конкретного места и времени, рассмотрена взаимосвязь характеристик экономических показателей в соответствии с причинами и источниками возникновения случайных погрешностей. Подчеркивается, что точность измерения показателей за длительный период времени определяется однородностью периодов развития. Показано, что несогласованность между официальными показателями может быть вызвана их разным расчетом для разных форм представления. Представлена зависимость общих проблем измерения цен и объема производства от признаков их обуславливающих. Рассмотрены индексы как стандартный прием анализа экономической динамики и показана взаимосвязь выбора базы сравнения и однородных интервалов анализа показателей. Рассмотрена возможность использования сцепленных индексов в анализе экономической динамики.

Ключевые слова: *экономический рост, однородность совокупности, типология данных, оценочный показатель, погрешность измерения, индексный анализ.*

....

In a market economy, its development is connected with economic growth and macroeconomic instability. Economic growth determines the production capacity of the economy and helps solve the problem of limited resources. Macroeconomic instability is most often manifested in the cyclical fluctuations of the national product value, employment and price level.

Considering the cyclical nature of the economy as a form of social production nonuniformity, the issue of adequate assessment of current trends in the development of national economy is topical.

The fundamentals of the theory of economic growth have been studied by A. Smith, J. Schumpeter. The fundamentals include the models of R. Solow, as well as the study of the economic development processes by R. Lucas, P. Romer, and J. Stiglitz. A contribution to the growth theory has also been made by S. Kuznets, F. Braudel, T. Schultz, G. Becker, N. Kondratyev and other scientists

Modern problems of the analysis of macroeconomic dynamics, the measurement of economic growth have been investigated by I. M. Tenyakov, V. A. Bessonov, K. S. Aynabek, A. I. Orlov and others [1 – 4].

But, rightly focusing on the models which help to explore the conditions for achieving the equilibrium rate of economic growth and develop a long-term economic policy; the use of production functions which have the property of constant returns of scale; the layout of the list of performance indicators, the researchers pay insufficient attention to the correspondence between the collection process, the primary data processing and the economic content of the problem researched.

The validity of the analytical output depends on what you are looking for.

Therefore, the clarity of understanding of such points as:

what information must be collected, and what sources should be used for this purpose;

3

whether the information collected is consistent with the economic substance of the problem researched;

what method of data measurement makes it possible to generate a performance evaluation system correct for the given situation determines the list of the basic tasks in conducting economic research and affects its results.

The emergence of new economic entities, their qualitative heterogeneity, the growing influence of environmental factors, as well as the impropriety of managerial decision-making, both in the assessment of current trends and forecasting future development requires correct ordering of information and determination of the level of its homogeneity.

A necessary and sufficient condition for working with data sets is their accuracy and comparability.

The purpose of the research is to identify a list of the main problems when working with data sets that affect the formation of the general scheme of the economic growth study.

The initial stage of analytical work is the formation of a statistical population as the object of study in accordance with the issue under consideration.

Based on the above conditions of the declared accuracy and comparability of information in the creation of economic development programs, such totality must necessarily take into account the nature of the relationship of shadow economy and official output.

The shadow economy reflects the operation of market mechanisms, while the latter determines the overall dynamics of the structural changes necessary for economy diversification.

Therefore, a relatively precise determination of the scope of the shadow economy in the macroeconomic characteristics of country's development will make it possible to reflect both the future reserves of the economic growth, and the limitations on using them.

The special nature of such a complex object as the economy of any country is not confined to the peculiarities of its constituent elements.

The integrity of the system determines the nature of connections and relationships between its elements.

If the system elements have the same general properties and the identified patterns are reflected in all the elements, then such a system is considered to be qualitatively homogeneous.

Within the quality uniformity there is always a quantitative heterogeneity, the variations of signs that change individual properties.

Solving these problems of homogeneity is a prerequisite for the correct analysis but the choice of method is determined by the structure of a particular system.

Typology focuses on the reflection of the system structure, identification of patterns that allow a researcher to anticipate unknown situations.

Typology is based on the identification of similarities and differences between the studied objects and search of reliable ways to reflect them (Fig. 1) [5].
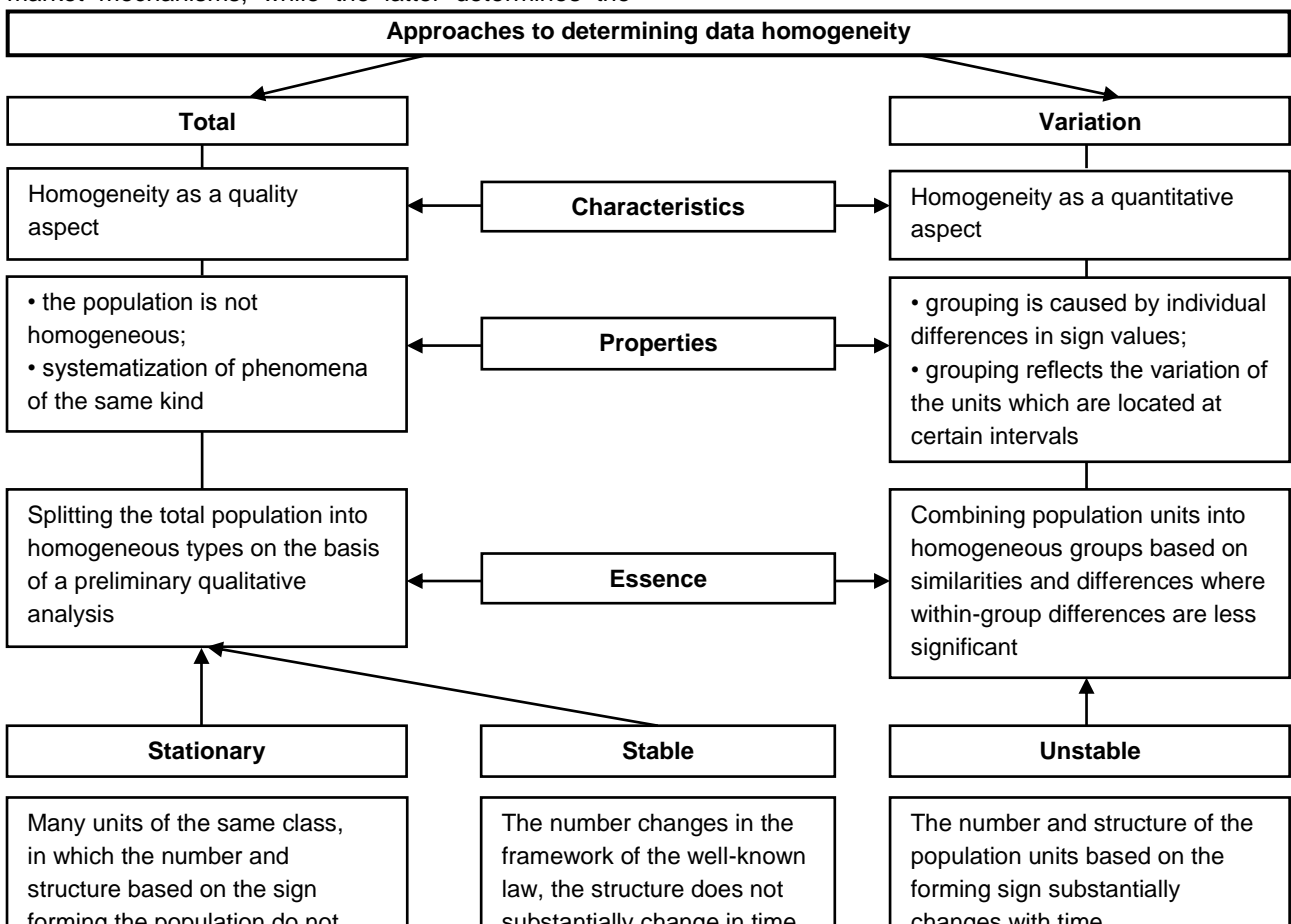

Approaches to determining data homogeneity		
Total		**Variation**
Homogeneity as a quality aspect	**Characteristics**	Homogeneity as a quantitative aspect
• the population is not homogeneous; • systematization of phenomena of the same kind	**Properties**	• grouping is caused by individual differences in sign values; • grouping reflects the variation of the units which are located at certain intervals
Splitting the total population into homogeneous types on the basis of a preliminary qualitative analysis	**Essence**	Combining population units into homogeneous groups based on similarities and differences where within-group differences are less significant
Stationary	**Stable**	**Unstable**
Many units of the same class, in which the number and structure based on the sign forming the population do not	The number changes in the framework of the well-known law, the structure does not substantially change in time	The number and structure of the population units based on the forming sign substantially changes with time

Fig. 1. **The relationship of the population type and approaches to determining their homogeneity**

Thus, data typology determines the correctness of the subsequent analysis [6].

An integral part of the data analysis methods that provide for obtaining reliable conclusions is the measurement theory.

In modern analytical practice, the use of modern data mining algorithms is possible only after determining the types of measurement scales of the variables studied.

The scale type is determined by a valid transformation which keeps the relationship between elements of the system invariable.

Figuring out the type of scales is necessary for an adequate choice of the data analysis methods.

Specifics of economic measurement is the presence of a large number of heterogeneous data.

Their quantitative certainty is voluminous and structural.

While volumetric characteristics determine the scale of a phenomenon, the structural ones define the hierarchy and organization.

In economics, it is impossible to carry out measurements with a split hair accuracy.

The accuracy of economic measurements is related to:

• the definition of the economic value;

• the formation of a system of theoretical principles justifying the concept of accuracy;

• the definition of an indicator;

• basing selection of scales;

• taking into account the rules of formation of the system of indicators;

• the definition of methods eliminating measurement errors;

• the development of the rules of aggregation of indicators;

• comparison of indicator terms;

• the development of measurement rules.

The database for economic research includes official statistics and accounting data.

While economic theory makes it possible to trace a connection between the signs and indicators, statistics and accounting determine the choice of indicators to assess results.

Each component performs a specific analysis and evaluation function, reflects the economic rela- tions, i.e. characterizes a certain property of an object, a process or a system.

Characteristics of economic indicators in ac- cordance with the causes and sources of occurrence of random errors have the following relationship (Fig. 2).
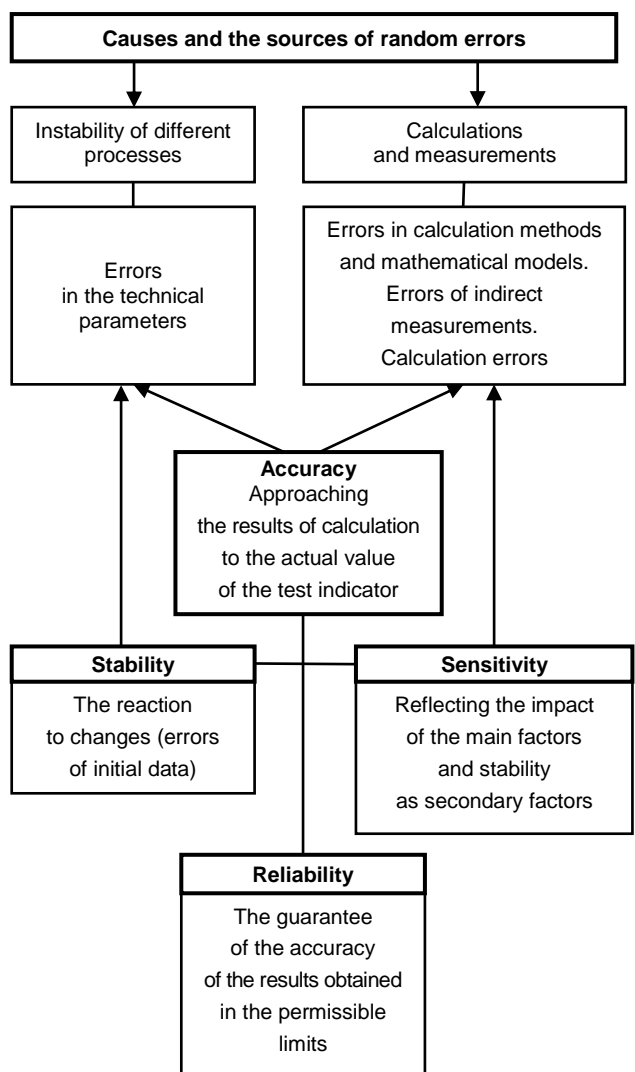

Fig. 2. **The characteristics of economic indicators**

Thus, the measurement is complete when measurement results and the estimation of its error are found with maximum precision.

Characteristics of economic indicators will be more accurate if we define the quality of measurements in similar periods of development.

A qualitative leap in the dynamics of the process which leads to a change in pattern is preceded by its continuous quantitative change.

Therefore, when studying the changes in estimates made over a long period of time it is necessary to determine the uniform intervals.

Determination of homogenous periods of development is the goal of periodization.

From a theoretical point of view, if the change is subject to a number of levels of the same distribution law, the homogeneity of the development period can be assumed.

From a practical point of view it is better to consider a uniform time period corresponding to one of the following situations:

1. $Y_{t_i} = Y_{t_j} = C_1$ – equality of levels of time series;

2. $\Delta Y_{t_i} = \Delta Y_{t_j} = C_2$ – equality of absolute increases, i.e. a constant rate of changes of the series levels;

3. $\Delta\Delta Y_{t_i} = \Delta\Delta Y_{t_j} = C_3$ – equality of the second absolute differences, i.e. constantly faster or slower changing of the series levels;

4. $\dfrac{Y_{t_i}}{Y_{t_j}} = C_4$ – equality of continued growth,

where, t_i, t_j are time moments or intervals;

$\Delta Y_{t_i} = Y_{t_i} - Y_{t_j}$ is the chain absolute growth;

$\Delta\Delta Y_{t_i} = (Y_{t_i} - Y_{t_{i-1}}) - (Y_{t_{i-1}} - Y_{t_{i-2}})$ is the second difference level of time series.

Periodization provides important information about the process and ensures its adequate use for analysis of multivariate statistics methods.

Thus, based on the logic of judgment relationship, the necessary conditions for the implementation of a correct assessment of economic growth include:

• fullness of the frame population based on the study of the problem;

• selection of the data typology based on the particular set of structures;

• selection of the measurement scale for allowable changes;

• analysis of the causes and sources of random errors;

• selection of homogeneous periods in the development of the phenomenon under study.

The sufficient condition is the selection of effective tools for the analysis and assessment of economic growth.

The concept of economic development is based on the analysis of a small number of indicators. The problems of construction and interpretation of these indicators may significantly affect both the result of the study and decision making.

The basic indicator of economic growth is gross domestic product per capita [1].

Let us consider the options for calculating this indicator, which is of interest from the standpoint of consistency of research objectives and methods for achieving them.

Table 1

The ways of calculating the GDP per capita, thousands of UAH

Indicator		Numerical values of the indicator	The ways of calculating the GDP per capita		
			Artificially increased macroeconomic indicator	Real poor state of economy	Official calculations
The GDP, mln UAH	current prices	201.9	current prices / resident population	base prices / actual population	current prices / actual population
	base prices	113.8			
Population, mln	actual	48.475	4.186	2.349	4.167
	resident	48.241			

The correct determination of the GDP per capita is rather difficult because there are different numerical values of the same indicator in the official statistics. Census is calculation of the entire set of measurements taken from the whole population. The first Ukrainian census was carried out on December 5, 2001, so this information was used for comparison.

The method of calculating the indicator is adjusted for the purpose of the study.

In Ukraine the population figures are determined on January 1 of the current year, that is, at a specific point of time, but the GDP is defined for the whole current year, that is for a period of time.

So, the researchers took into account the economic concept of the indicator, but did not take into account the method of data collection.

The indicators must be measured with the same method.

In order to obtain the correct economic indicators its numerator and denominator must be calculated according to the same rules.

That is, the average annual resident population must be calculated for the correct determination of the GDP per capita.

The presence of calculation inconsistencies of the indicator numerator and denominator based on the time factor disfigures the accuracy and impeaches the possibility of further comparison.

Since the theoretical basis of macroeconomic dynamics analysis is inflation and change in output it is expedient to systematize the general problems of measuring price and volume of production in accordance with their conditioning signs (Table 2).

Table 2

The general scheme of the relationship of measurement problems and signs causing them

The problem of the price dynamics measurement	Sign classification	The problem of measuring the dynamics of production
High inflation. Significant change in the quality of goods and services. Interchangeability of outlets participating in the survey of prices	Basic factors of influence	Large-scale structural changes. Incomparability of goods (services) – representatives. Typical goods (services) – representatives for the cost structure
Long-term comparison	Area of concentration	Short-term comparison
Considerable incomparable variability	Variability	Negligible volatility
Running observation. Sampling	Registration concept	Running observation. Sampling. Study of the main mass data
Possibility of systematic increase of prices	Scale of measurement	Possibility of systematic decline of production
Average indicator Indices	Indicator type	Specific weight of physical indicators. Index method
Substantial	Impact on performance	Not always essential

The above systematization makes it possible to take into account, at the initial stage of the economic dynamics analysis, the time change in proportions between the prices and the volume of production of goods and services.

The standard totals for analyzing economic dynamics are indices [7; 8].

The correct taking into account of the impact of individual indices on the formation of a composite index derived by their aggregation allows a researcher to find out due to what goods-representatives and to what extent a change in the economic processes takes place.

In analytical practice, a standard requirement for the composite indices of prices and quantities is the requirement of conformity of the product to cost index.

To reach this conformity the method of constructing price indices and the quantities should be agreed in terms of the initial data, consumer baskets, weights and the index formulae.

The error magnitude allows for making a conclusion about the accuracy of indices.

Since one of the problems of the correct operation with data is the choice of the comparison base and selection of homogeneous intervals of the indicator analysis with the formed index available any period covered by it may be taken as a base.

Besides, it is necessary to take into account such important points as:

• the index database must be the same as:

1) the weight base;

2) the last weight base in the case when the index is a joined time series and has a weight basis;

• the index base should not be too far from the current period;

• the selected period should be without any drastic price changes.

However, the variation of the summary index values usually increases with the time interval between the compared periods.

On the basis of these indices it is not possible to compare two situations for which a plurality of typical representatives is significantly different.

The weights of the current period may differ from the proportions corresponding to the weight base, and the weight base approach for the current period can

lead to a deterioration of the representativeness of the respective periods of the index time series.

In this situation it is necessary to adjust the composition of the product basket over time.

In order to reduce the impact of the choice of the index formula on the result of comparison, it is advisable to use concatenated indices.

Concatenating allows the researcher to construct a composite index with a weight close to the base of each level of the time series.

If the value of the composite price indices and the quantity depends on the information at the end of the interval comparison, then the index is characterized by dependence of their values on the path.

Thus, the lack of a clear understanding of the economic essence of the phenomenon under study, as well as the composition and characteristics of the formation of the structure of the studied population, the improper use of the measurement system and the subsequent selection of the list of performance indicators make the economy partially unobservable.

The considered sequence of necessary and sufficient conditions for the correct assessment of economic growth makes it possible to:

• reduce the level of error in the formation of the original data set;

• establish a system of performance indicators that will reflect the real situation more adequately;

• choose the method of analytical evaluation of specific tasks based on the purpose of the study and requests of information consumers.

References: 1. Теняков И. М. Современные проблемы измерения экономического роста / И. М. Теняков // Инновационное развитие экономики России: сценарии и стратегии : Пятая международная научная конференция, 18 – 20 апреля 2012 г., МГУ им. М. В. Ломоносова, экономический факультет, Москва : сборник статей. – Т. 1. – Москва : ТЕИС, 2012. – С. 139–146. 2. Бессонов В. А. Проблемы анализа российской макроэкономической динамики переходного периода / В. А. Бессонов. – Москва : ИЭПП, 2005. – 244 с. 3. Айнабек К. С. Теория общественного хозяйствования (Альтернатива экономической теории и экономикса) : учебник ; испр. и доп. / К. С. Айнабек. – Караганда : КЭУК, 2014. – 608 с. 4. Орлов А. И. Новая парадигма математических методов экономики / А. И. Орлов // Экономический анализ: теория и практика. – 2013. – № 36 (339). – С. 25–30. 5. Глинский В. В. Методы типологии данных в социально-экономических исследованиях: автореф. дис. ... докт. экон. наук : спец. 08.00.12 / В. В. Глинский ; С.-Петерб. гос. ун-т экономики и финансов. – Санкт-Петербург, 2009. – 35 с. 6. Орлов А. И. Теория измерений как часть методов анализа данных: размышления над переводом статьи П. Ф. Веллемана и Л. Уилкинсона / А. И. Орлов // Социология: методология, методы и математическое моделирование. – 2012. – № 35. – С. 155–174. 7. Сигел Э. Практическая бизнес-статистика / Э. Сигел ; пер. с англ. – Москва : ИД "Вильямс", 2002. – 1056 с. 8. Floyd J. E. Statistics for economists: a beginning [Electron-

ic resource] / J. E. Floyd. – University of Toronto, 2010. – Access mode : https://www.economics.utoronto.ca/jfloyd/stats/ecstats.pdf. 9. Буховец А. Г. Системная интерпретация результатов классификационных задач / А. Г. Буховец // Социология: методология, методы и математическое моделирование. – 2006. – № 22. – С. 114–144. 10. Barrett P. T. The Observation to Variable Ratio in Factor Analysis [Electronic resource] / P. T. Barrett, P. Kline // Personality Study and Group Behavior. – 1981. – No. 1. – P. 23–33. – Access mode : http://www.pbarrett.net/publications/Observation-to-Variable-Ratio-Barrett-and-Kline-1981.pdf. 11. Jackson J. International economic law in times that are interesting / J. Jackson // Journal of International economic law. – 2000. – Vol. 3, No. 1. – P. 3–14. 12. Lind D. A. Statistical Techniques in Business and Economics / D. A. Lind, W. G. Marchal, S. A. Wathen. – 15th edition. – S. l. : Mcgraw-Hill/Irwin, 2011. – 800 p. 13. Lucas R. E. On the Mechanics of Economic Development / R. E. Lucas // Journal of Monetary Economics. – 1988. – January. – P. 3–42. 14. Томас Р. Количественный анализ хозяйственных операций и управленческих решений : учебник / Р. Томас ; пер. с англ. науч. ред. В. М. Матвеева. – Москва : Дело и сервис, 2003. – 432 с. 15. Цыпин А. П. О статистических методах периодизации исторических временных рядов макроэкономических показателей / А. П. Цыпин // Вестник НГУЭУ. – 2014. – № 4. – С. 88–100 ; [Электронный ресурс]. – Режим доступа : http://nsuem.elpub.ru/jour/article/view/14.

References: 1. Tenyakov I. M. Sovremennye problemy izmereniya ekonomicheskogo rosta / I. M. Tenyakov // Innovatsionnoe razvitie ekonomiki Rossii : stsenarii i strategii : Pyataya mezhdunarodnaya nauchnaya konferentsiya, 18 – 20 aprelya 2012 g., MGU im. M. V. Lomonosova, ekonomicheskiy fakultet, Moskva : sbornik statey. – Vol. 1. – Moskva : TEIS, 2012. – P. 139–146. 2. Bessonov V. A. Problemy analiza rossiyskoy makroekonomicheskoy dinamiki perekhodnogo perioda / V. A. Bessonov. – Moskva : IEPP, 2005. – 244 p. 3. Aynabek K. S. Teoriya obshchestvennogo khozyaystvovaniya (Alternativa ekonomicheskoy teorii i ekonomiksa) : uchebnik ; isprl. i dop. / K. S. Aynabek. – Karaganda : KEUK, 2014. – 608 p. 4. Orlov A. I. *Novaya paradigma matematicheskikh metodov ekonomiki* [The new paradigm of the mathematical economics] / A. I. Orlov // Ekonomicheskiy analiz: teoriya i praktika. – 2013. – No. 36 (339). – P. 25–30. 5. Glinskiy V. V. Metody tipologii dannykh v sotsialno-ekonomicheskikh issledovaniyakh: avtoref. dis. ... dokt. ekon. nauk : spets. 08.00.12 / V. V. Glinskiy ; S-Peterb. gos. un-t economiki i finansov. – Sankt-Peterburg, 2009. – 35 p. 6. Orlov A. I. *Teoriya izmereniy kak chast metodov analiza dannykh : razmyshleniya nad perevodom stati P. F. Vellemana i L. Uilkinsona* [The theory of measurements as part of the data analysis methods : contemplation over translation of the article by P. F. Velleman and L. Wilkinson] / A. I. Orlov // Sotsiologiya: metodologiya, metody i matematicheskoe modelirovaniye. – 2012. – No. 35. – P. 155–174. 7. Sigel E. Prakticheskaya biznes-statistika / E. Sigel ; per. s angl. – Moskva : ID "Vilyams", 2002. – 1056 p. 8. Floyd J. E. Statistics for economists: a beginning [Electronic resource] / J. E. Floyd. – University of Toronto, 2010. – Access mode : https://www.economics.utoronto.ca/jfloyd/stats/ecstats.pdf. 9. Bukhovets A. G. *Sistemnaya interpretatsiya rezultatov klassifikatsionnykh zadach* [System interpretation of the classification problem results] / A. G. Bukhovets // Sotsiologiya: metodologiya, metody i matematicheskoe modelirovaniye. – 2006. – No. 22. – P. 114–144. 10. Barrett P. T. The Observation to Variable Ratio in Factor Ana-

lysis [Electronic resource] / P. T. Barrett, P. Kline // Personality Study and Group Behavior. – 1981. – No. 1. – P. 23–33. – Access mode : http://www.pbarrett.net/publications/Observation-to-Variable-Ratio-Barrett-and-Kline-1981.pdf. 11. Jackson J. International economic law in times that are interesting / J. Jackson // Journal of International economic law. – 2000. – Vol. 3, No. 1. – P. 3–14. 12. Lind D. A. Statistical Techniques in Business and Economics / D. A. Lind, W. G. Marchal, S. A. Wathen. – 15th edition. – S. l. : Mcgraw-Hill/Irwin, 2011. – 800 p. 13. Lucas R. E. On the Mechanics of Economic Development / R. E. Lucas // Journal of Monetary Economics. – 1988. – January. – P. 3–42. 14. Tomas R. Kolichestvennyy analiz khozyaystvennykh operatsiy i upravlencheskikh resheniy : uchebnik / R. Tomas ; per. s angl. nauch. red. V. M. Matveeva. – Moskva : Delo i servis, 2003. – 432 p. 15. Tsypin A. P. *O statisticheskikh metodakh periodizatsii istoricheskikh vremennykh ryadov makroekonomicheskikh pokazateley* [About statistical methods of devision into periods of historical time series of macroeconomic indices] / A. P Tsypin // Vestnik NGUEU. – 2014. – No. 4. – P. 88–100 ; [Electronic resource]. – Access mode : http://nsuem.elpub.ru/jour/article/view/14.

Information about the author

I. Serova – PhD in Economics, Professor of the Department of Statistics and Economic Forecasting of Simon Kuznets Kharkiv National University of Economics (9-A Nauky Ave., Kharkiv, Ukraine, 61166, e-mail: irina-ce@yandex.ru).

Інформація про автора

Сєрова Ірина Анатоліївна – канд. екон. наук, доцент кафедри статистики та економічного прогнозування Харківського національного економічного університету імені Семена Кузнеця (просп. Науки, 9-А, м. Харків, Україна, 61166, e-mail: irina-ce@yandex.ru).

Информация об авторе

Сєрова Ирина Анатольевна – канд. экон. наук, доцент кафедры статистики и экономического прогнозирования Харьковского национального экономического университета имени Семена Кузнеца (просп. Науки, 9-А, г. Харьков, Украина, 61166, e-mail: irina-ce@yandex.ru).

9